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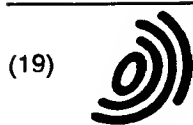
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(54) Catheter connector

(57) Compressible lock washers for use in catheter connectors. One such lock washer (60) includes a support ring (62) and tube engagement flanges (64A to 64D) extending centrally therefrom, oblique to the ring and each extending from the same side thereof. The tube engagement flanges (64A to 64D) define a tube receptacle (72) through which a catheter tube (58) may

be inserted. Upon compression of the lock washer (60), the tube engagement flanges are forced toward the ring (62), decreasing the diameter of the tube receptacle (72). Thus, during compression of the lock washer (60), the tube engagement flanges engage the catheter tube which runs through the tube receptacle (72), securing the catheter tube within the catheter connector with which the lock washer is associated.

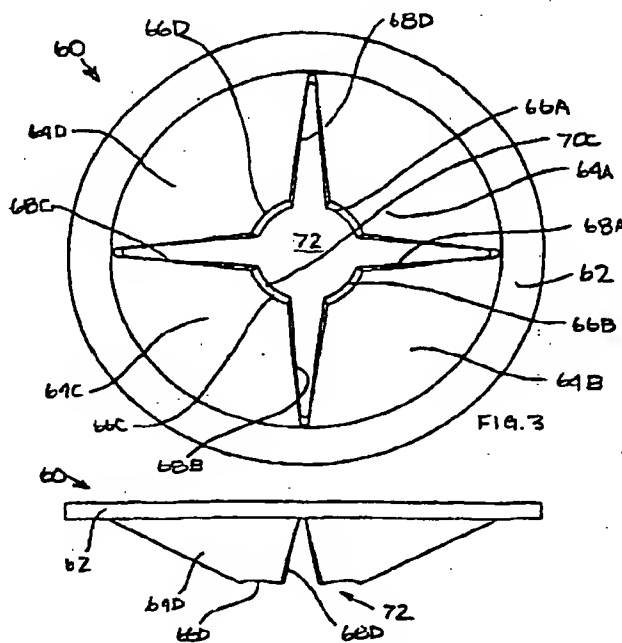


FIG.4

The body of the cap 22 defines an elongated lumen 40 that is open to the proximal end of the cap and extends approximately centrally through the cap and into the alignment element 48 thereof. The alignment element 48 includes an end wall 56, thus lumen 40 includes a closed end. The cap 22 also includes a center member receptacle 51 formed in the distal end thereof for receiving and engaging the proximal end of the center member 24 (*i.e.*, locking element 49, described below). The center member receptacle 51 include an interconnect component 50 (*e.g.*, a LEUR LOCK™ receptacle) formed therein.

[0022] The center member 24, which is also referred to as a second member for simplicity, is a generally hollow cylindrical member including a body that defines a lumen 44 entirely therethrough. An insertion member receptacle 26 is disposed about the periphery of the center member 24, proximate the distal end of the same. The insertion member receptacle 26 is configured to receive the proximal end of the insertion member 28 and interconnect therewith (*e.g.*, by threads). The proximal end of the center member 24 includes a hollow, cylindrical extension, which is referred to as a locking element 49. The proximal end of the lumen 44 is defined by locking element 49 and is configured to receive the alignment element 48 of the cap 22. The cross-sectional diameter of the lumen 44 may decrease near the distal end of the center member 24. The locking element 49 includes locking elements 52 (*e.g.*, LEUR LOCK™ extensions) adjacent the distal end thereof, which are configured to engage the interconnect component 50 of the cap 22.

[0023] The insertion member 28, which is also referred to as a first member for simplicity, is also a generally hollow cylindrical member including a body that defines an elongated lumen 30 through the center thereof, a distal end 54, and a substantially round aperture 42 formed approximately centrally through the distal end. The proximal end of the insertion member 28 includes an interconnection component 46 (*e.g.*, external threading) that is complementary to a first receptacle 26 (which includes, *e.g.*, internal threading) and configured to interconnect therewith. The lumen 30 is configured to receive a gasket 32. The distal end aperture 42 is configured to facilitate the insertion of a catheter tube 58 therethrough.

[0024] The lock washer 60 and gasket 32 are disposed within the lumen 30 of the insertion member 28 and are held into place by the interconnection of the insertion member 28 with the center member 24. In order to interconnect the center member 24 and the insertion member 28, the interconnection component 46 of the insertion member 28 is inserted into and engaged by the receptacle 26 of the distal end of the center member 24.

[0025] With reference to FIG. 2, a preferred gasket 32 is an elongated, compressible, resilient, somewhat cylindrical element which defines a channel 34 centrally therethrough. The channel 34 has an inner diameter slightly larger than the outer diameter of a catheter tube

58 to be inserted therein, thus facilitating the insertion of a catheter tube therein. The gasket 32 includes a frustoconically tapered distal end 36 and a proximal end 38. The lock washer 60 abuts the proximal end 38 of the gasket 32.

[0026] Referring now to FIGs. 3 and 4, a preferred lock washer 60 includes a support ring 62, which is also referred to as a ring for simplicity, formed or positioned around the perimeter thereof are flared tube engagement flanges 64A, 64B, 64C, 64D extending centrally from the ring 62. A compression slot 68A, 68B, 68C, 68D is defined by the lateral edges of each adjacent pair of tube engagement flanges 64, and is therefore located therebetween. FIGs. 3 and 4 depict the lock washer 60 and its tube engagement flanges 64A, 64B, 64C, 64D in a relaxed, or flared, state. As FIG. 4 illustrates, in the relaxed state of the lock washer 60 and the tube engagement flanges 64A, 64B, 64C, 64D, the tube engagement flanges impart the lock washer with a generally conical shape. Each tube engagement flange 64 is a resilient member that includes a central tip 66A, 66B, 66C, 66D. Preferably, each central tip 66 includes a concave arc 70A, 70B, 70C, 70D. The collective, concave shape of all of the central tips 66A, 66B, 66C, 66D defines a generally rounded tube receptacle 72 through the center of the lock washer 60. Thus, the central tips 66A, 66B, 66C, 66D, and therefore the tube receptacle 72, are configured to receive a catheter tube 58 (*see* FIG. 11) inserted through the lock washer 60 while the lock washer is in the relaxed state (*see* FIGs. 3 and 4), and engage the catheter tube without damaging or closing off the lumen through the same as the lock washer 60 is placed into the engaged state.

[0027] FIGs. 5 and 6 illustrate lock washer 60 and its tube engagement flanges 64 in an engaged state, wherein the tube engagement flanges are flexed towards the center of a plaque in which the ring 62 lies. Consequently, the lateral edges of adjacent tube engagement flanges 64 are forced toward one another and the size of the compression slots 68A, 68B, 68C, 68D is reduced. Additionally, the cross-sectional diameter of tube receptacle 72 is thus decreased, such that it is at least slightly smaller than the outer diameter of a catheter tube 58 insertable therethrough.

[0028] FIGs. 7 through 10 show an alternative embodiment of the lock washer 60', which includes a support ring 62' formed around the perimeter thereof, flared tube engagement flanges 64A', 64B', 64C', 64D' and a thin, flexible, resilient, collapsible web 68'A, 68'B, 68'C, 68'D disposed between and adjoining the lateral edges of adjacent tube engagement flanges 64'. FIGs. 7 and 8 illustrate the lock washer 60' in a relaxed, or flared, state, wherein the lock washer has a generally conical appearance. FIGs. 9 and 10 show the lock washer 60' in an engaged state, wherein the tube engagement flanges 64A', 64B', 64C', 64D' have been flexed toward the ring 62'.

[0029] Each tube engagement flange 64A', 64B',

of said tube engagement flanges define a compression slot therebetween.

4. The lock washer of claim 1, further comprising a collapsible, web disposed between adjacent ones of said tube engagement flanges.
5. The lock washer of claim 1, wherein said tube engagement flanges are flexible towards the center of a plane defined by the periphery of said ring.
6. The lock washer of claim 5, wherein upon flexion of said tube engagement flanges towards the center of said ring, the diameter of said tube receptacle decreases.
7. The lock washer of claim 5, wherein following the release of a compressive load from said lock washer periphery, said tube engagement flanges resiliently flex back to a relaxed state.
8. The lock washer of claim 5, wherein adjacent ones of said tube engagement flanges define a compression slot therebetween.
9. The lock washer of claim 5, further comprising a web disposed between adjacent ones of said tube engagement flanges.
10. The lock washer of claim 9, wherein, upon flexion of said adjacent ones of said tube engagement flanges toward said ring, said web collapses upon itself.
11. The lock washer of claim 9, wherein, following flexion of said tube engagement flanges, said tube engagement flanges return to a relaxed state and said web re-expands to an original state.
12. The lock washer of claim 1, wherein each said central tip comprises a concave arc.
13. A lock washer comprising:
 - a ring defining a periphery of the lock washer; and
 - a plurality of resilient tube engagement flanges associated with said ring and extending therefrom, each of said tube engagement flanges having a relaxed state and an engaged state, and each including a central tip, said central tips of selected ones of said plurality of tube engagement flanges defining a tube receptacle through the lock washer for receiving a tube.
14. The lock washer of claim 13, wherein adjacent ones of said tube engagement flanges define a compression slot therebetween.

15. The lock washer of claim 13, further comprising a web extending between and adjoining adjacent ones of said tube engagement flanges.

16. The lock washer of claim 13, wherein each of said tube engagement flanges are proximally compressible with respect to said ring.
17. The lock washer of claim 17, wherein, upon applying a compressive load to said tube engagement flanges, said tube engagement flanges flex into said engaged state.
18. The lock washer of claim 17, wherein, upon compression of said tube engagement flanges, the inner diameter of said tube receptacle decreases.
19. The lock washer of claim 17, wherein, following the release of a compressive load, said tube engagement flanges flex into said relaxed state.
20. A catheter connector assembly comprising:

a first member including a body which defines a first lumen therethrough;
 a second member having a first and second ends and including a body which defines a second lumen therethrough, said second member being interconnectable with said first member at said first end; and
 a lock washer disposed within one of said first and said second lumens, said lock washer including a ring and a plurality of compressible tube engagement flanges associated therewith extending centrally therefrom and defining a tube receptacle.

21. The catheter connector assembly of claim 20, wherein each of said tube engagement flanges includes a central tip, all of said central tips defining a tube receptacle through said lock washer upon compression of the lock washer.
22. The catheter connector assembly of claim 21, further comprising a cap interconnectable with the second end of said second member.
23. The catheter connector assembly of claim 22, wherein interconnection of said first member and said second member decreases the diameter of said tube receptacle.
24. The catheter connector assembly of claim 21, further comprising a tube positioned within said tube receptacle.

